1. THE EVOLUTION OF STELLAR DYNAMOS
2. SURVEY FOR LOW MASS MEMBERS OF NGC2232
3. AN X-RAY SURVEY OF THE OPEN CLUSTER CR140
4. TOWARDS A BETTER UNDERSTANDING OF THE ROTATION-ACTIVITY RELATION FOR SOLAR-TYPE MEMBERS OF THE PLEIADES

Grant NAG5-2203

Annual Performance Report No. 2

For the period 1 March 1996 through 28 February 1997

Principal Investigator:

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December 1996

Prepared for
National Aeronautics and Space Administration
Washington, D.C.

Smithsonian Institution
Astrophysical Observatory
Cambridge, Massachusetts 02138-1596

The Smithsonian Astrophysical Observatory
is a member of the
Harvard-Smithsonian Center for Astrophysics

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1. The Evolution of Stellar Dynamos and
2. Survey For Low Mass Members Of NGC2232
3. An X-Ray Survey of the Open Cluster Cr140
4. Towards a Better Understanding of the Rotation-Activity Relation for Solar-Type Members of the Pleiades

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This is the sixth performance report (the second on an annual rather than semi-annual basis) for our ROSAT grant NAG5-2203. The original grant for the Stellar Dynamos project has been augmented to include three additional approved ROSAT projects.

ROSAT/Stellar Dynamos (IC4665)

During this period much work was performed on the IC4665 project due to the availability of the complete set of data from the first ROSAT HRI observation. (The second half of the total 70-ksec observation in IC4665 was received during Summer 1996.) A proposal to observe a second HRI field in this cluster to enlarge the sample of IC4665 members studied in x-rays (particularly among M dwarfs) was approved for the AO7 ROSAT cycle, and thus a second HRI field may eventually be obtained in this cluster. Under direction from M. Giampapa (NOAO) and T. Fleming (UA), detection analysis was performed on the HRI data to derive an x-ray source list containing positional and flux information. C. Prosser reviewed this source list to determine the reality of weaker sources, and correlated the resulting x-ray sources with catalogued stars in the cluster region.

During Summer 1996, C. Prosser undertook a queue observing program with the FLWO 60-inch telescope using the FAST CCD spectrograph to obtain spectra of solar-type IC4665 members for spectral type classification purposes. Together with previous spectra obtained in 1994, the additional observations permitted the classification of all radial velocity members previously identified by Prosser and Giampapa (1994) along with a selection of other candidate members in the region. We gratefully acknowledge the observer Perry Berlind in obtaining the requisite FAST observations for this program. The resulting spectral types are useful for confirming cluster membership and estimating other stellar parameters employed in studies of these stars.

C. Prosser has drafted a paper reporting the x-ray and optical information in IC4665, including the results of Keck echelle spectra of a selection of M dwarfs in the cluster. Forty-three x-ray sources have been detected, of which 22 are found to be associated with known members/candidate members, 6 associated with nonmember stars, and 15 remaining "new" sources in the HRI field. At the present time, none of these additional 15 sources appears to correspond to a cluster member, indicating that the earlier proper motion survey in this region is perhaps fairly complete in regard to solar-type stars. In Figure 1, the resulting x-ray activity levels (in the form of Lx/Lbol) observed among IC4665 members is compared to that seen among Pleiades stars. Arrows and triangles denote upper limit measures to the x-ray luminosity for IC4665 and Pleiades stars respectively. This sort of comparison helps us to assess IC4665's evolutionary state relative to more well-studied clusters such as the Pleiades. A more detailed discussion of IC4665's properties will appear in publication.

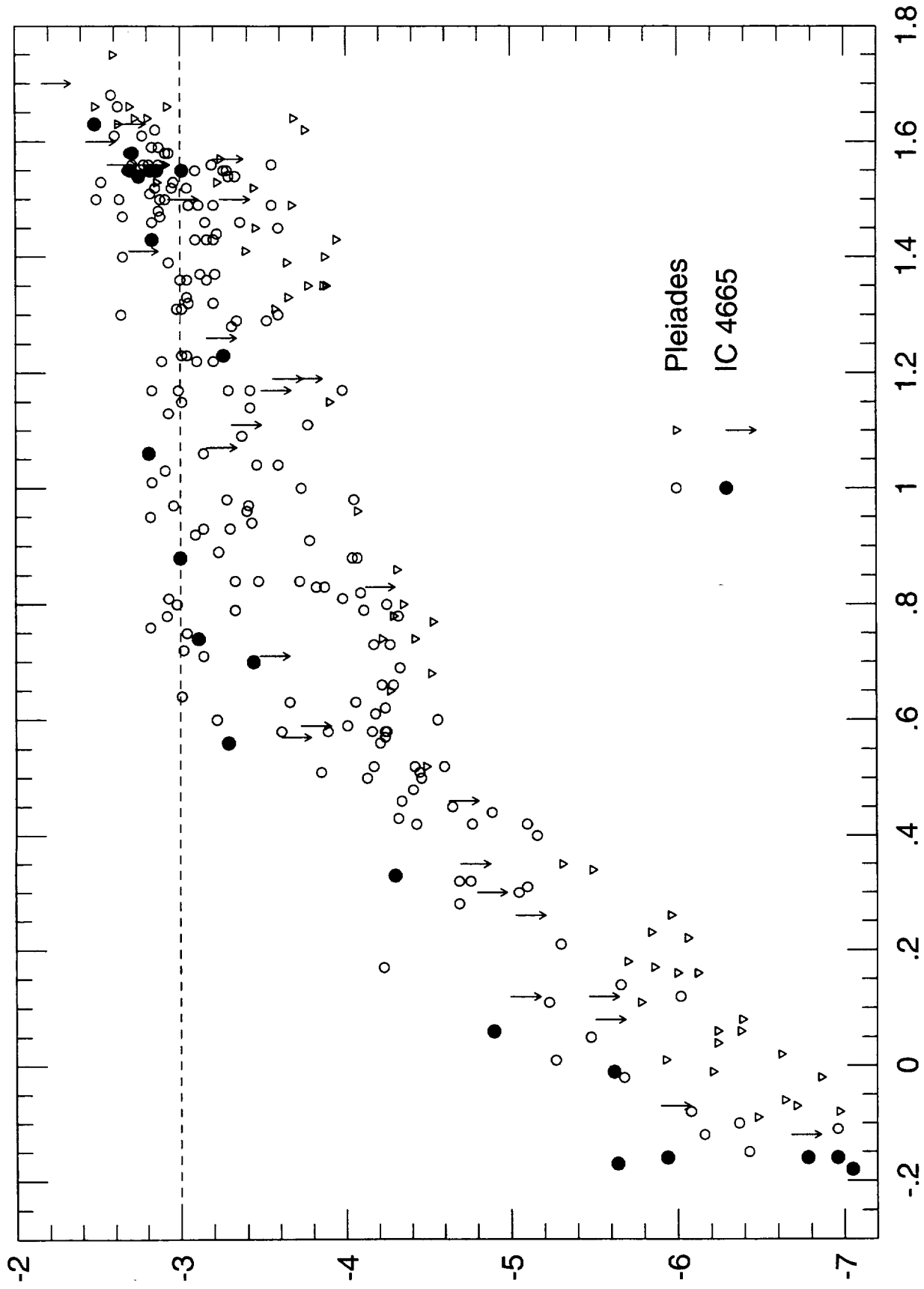

FIGURE 1